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Catheter Fracture: A Rare Complication of Totally Implantable Subclavian Venous Access Devices

HANS PETER KLOTZ, MD, WOLFGANG SCHÖPKE, MD, ARNOLD KOHLER, MD, BERNHARD PESTALOZZI, MD, AND FELIX LARGIADÈR, MD
From the Department of Surgery, Division of Visceral Surgery (H.P.K., A.K., F.L.), the Department of Medical Radiology (W.S.), and the Department of Internal Medicine, Division of Oncology (B.P.), University of Zurich Hospital, Zurich, Switzerland

Catheter fracture represents a rare problem among non-infectious complications following the insertion of totally implantable long-term central venous access systems for the application of chemotherapeutic agents. A literature survey revealed a total incidence of catheter fractures of 0–2.1%. Imminent catheter fracture can be identified radiologically, using different degrees of catheter narrowing between the clavicle and the first rib, called pinch-off sign. Two cases of catheter fracture are described and potential causes are discussed. Recommendations to avoid the pinch-off sign with the subsequent risk of catheter fracture and migration include a more lateral and direct puncture of the subclavian vein. In case of catheter narrowing in the clavicular-first rib angle, patients should be followed carefully by chest X-rays every 4 weeks. Whenever possible, the system should be removed within 6 months following insertion.

KEY WORDS: central venous catheterization, indwelling catheters, postoperative complications

INTRODUCTION

Insertion of totally implantable long-term central venous access systems has become a routinely performed intervention for application of chemotherapeutic agents and to take blood samples during the therapy. Long term results as well as surgical complications are well documented in the literature [1–3]. There is one rare complication, known as pinch-off sign, describing a compression of the catheter between clavicle and the first rib [4–6]. We present two cases of catheter fracture as a consequence of the pinch-off syndrome, as well as our suggestions to prevent this complication.

MATERIALS AND METHODS

Case Report 1

In July 1994, a 33-year-old woman presented with a high grade lymphocytic lymphoma of the epipharynx stage I. On August 16, 1994 a totally implantable central venous access system (Port-A-Cath, Kabi Pharmacia Deltec, St. Paul, MN) was implanted in the right subclavian vein using a Seldinger technique with a peel-away sheath. At the first attempt, the silicon catheter (diameter 9 French gauge) could not be inserted because of compression of the peel-away sheath between clavicle and first rib. Two additional attempts were necessary with more lateral puncture of the vein. The postoperative chest radiograph documented a proper position of the catheter with the tip in the upper vena cava (Fig. 1). No pinch-off sign could be demonstrated. Six days postoperatively, the patient made a trip to the mountains. During this time she carried a backpack for several hours.

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Address reprint requests to Dr. H.P. Klotz, Departement of Surgery, Division of Visceral Surgery, University of Zurich Hospital, Rämistrasse 100, CH-8091 Zurich, Switzerland.

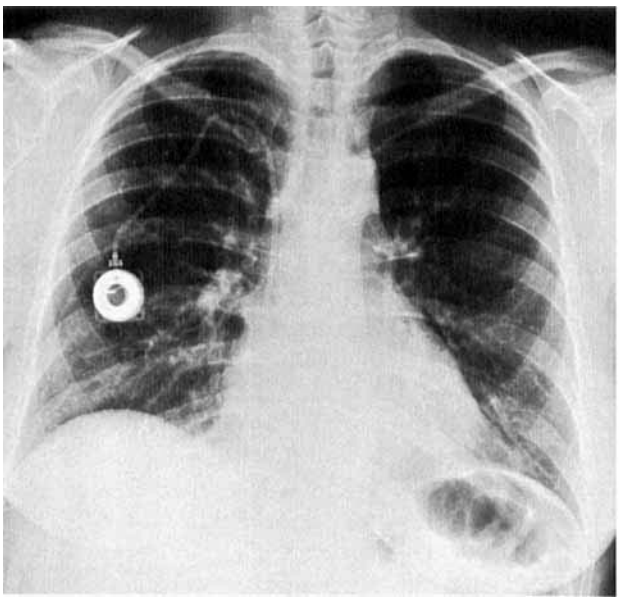

Fig. 1. Case report 1. Postoperative chest X-ray, documenting a proper position of the catheter without pinch-off sign.

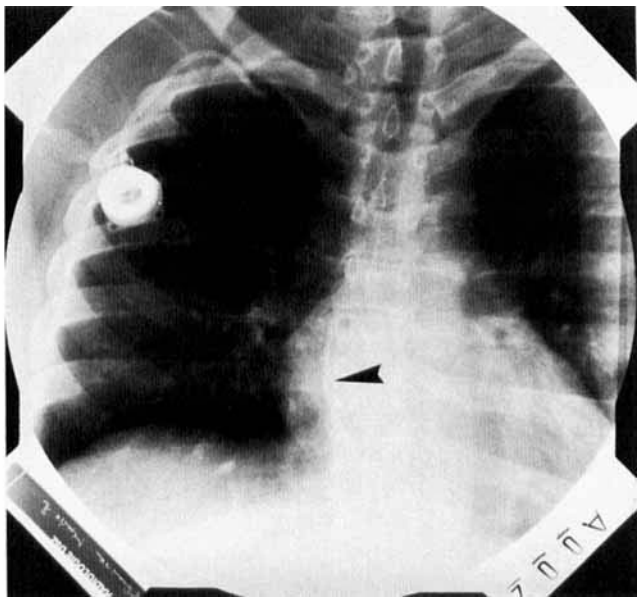

Fig. 2. Case report 1. Chest radiograph 3 weeks following catheter insertion, showing a fracture of the silicon catheter with the distal portion in the right atrium (arrow).

The first dosage of chemotherapy was given on the day of the implantation without problems. It comprised cyclophosphamide and doxorubicin, the first of 12 weekly cycles according to the VACOP-B schedule. Fourteen days later, on August 30, it was not possible to aspirate blood from the catheter and injection of 0.9% saline solution was very painful. Chest radiography showed a fracture and a change of direction of the catheter exactly below the clavicle (Fig. 2). The distal portion of the catheter had embolized into the right atrium. This fragment could be removed percutaneously through the right femoral vein. A thrombotic occlusion of the right subclavian vein had occurred. On the same day the proximal portion of the catheter and the port were removed under local anaesthesia. The remainder of the chemotherapy was administered using peripheral veins.

Case Report 2

A 44-year-old woman with metastatic carcinoma of the right breast had been admitted for systemic chemotherapy with cyclophosphamide, doxorubicin, and 5-fluorouracil (CAF-regimen). On January 16, 1995, a totally implantable central venous access system (Port-A-Cath, Kabi Pharmacia Deltec, St. Paul, MN) was implanted in the right subclavian vein using the Seldinger technique with a peel-away sheath. The insertion of the catheter (diameter 9 french gauge) was complicated because of a scar below the clavicle due to radical mastectomy in 1991 and radiotherapy of the thoracic wall in 1993. The postoperative chest X-ray demonstrated a typical pinch-off sign with a considerable angulation of the catheter below the clavicle (Fig. 3). Seven 3-weekly courses of chemotherapy were given until May 15, 1995.

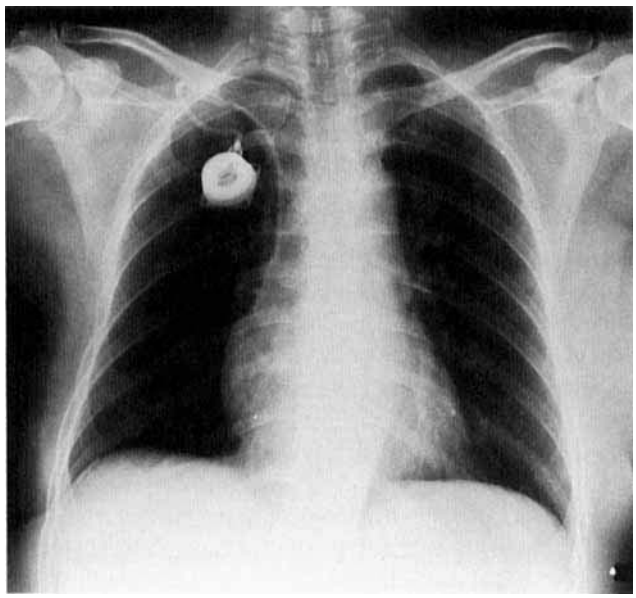

Fig. 3. Case report 2. Postoperative chest radiograph, documenting a pinch-off sign grade 2 with considerable angulation of the catheter below the clavicle.

Because no blood could be aspirated through the catheter, a chest radiograph was obtained on June 6, 1995. It showed a fracture of the silicon catheter below the clavicle

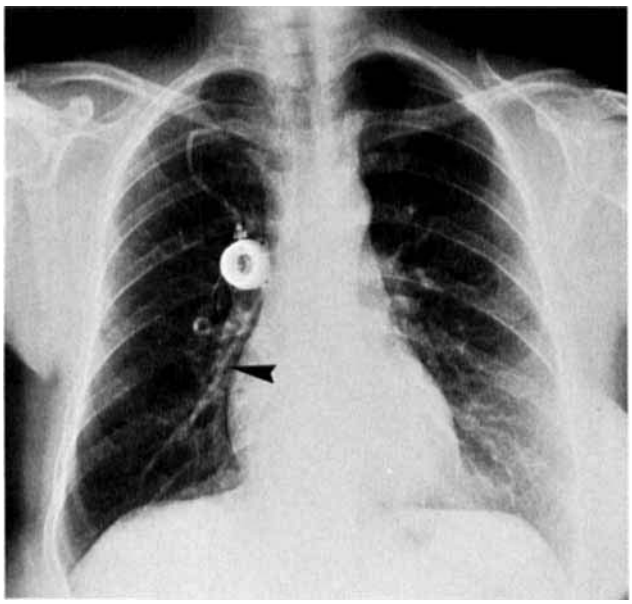

Fig. 4. Case report 2. Chest radiograph 5 months following catheter insertion, showing a fracture of the silicon catheter with the distal portion embolized to the right pulmonary vein (arrow).

with the distal portion of the catheter in the right pulmonary vein (Fig. 4). This distal fragment was removed percutaneously through the right femoral vein. On June 7, 1995 the proximal portion of the catheter and the port were removed and a second Port-A-Cath was implanted on the left side.

DISCUSSION

The use of the Seldinger technique with a peel-away sheath, has become a safe and rapid method to introduce a totally implantable long term central venous access system. The operative and postoperative complications are rare. Among the postoperative noninfectious complications, thrombotic occlusion of the catheter as well as mechanical complications have been described. In 1984 Aitken and Minton [4] first mentioned the so called "pinched-off sign," consisting of a narrowing of the catheter as it passes over the first rib and beneath the clavicle. At catheter insertion, the angle between the clavicle and the first rib is wide, and the catheter can pass through it medial to the vein before entering the subclavian vein. In the upright position, the angle narrows and leads to a mechanical compression of the medially positioned catheter. A catheter entering more lateral into the axillary vein enters the clavicular-first rib angle inside of the venous lumen. In this location, the angle is wider and the risk of catheter compression minimized.

In a series of 987 patients with implantable central venous access devices placed via the subclavian vein, Hinke et al. [5] found 11 cases (1.1%) with the pinch-off sign. He defined a radiographic scale of catheter distortion: grade 0, no distortion, catheter runs a smooth curved course in the region of the clavicle and the first rib; grade 1, abrupt change in direction, but no luminal narrowing; grade 2, some degree of luminal narrowing; grade 3, complete catheter fracture; 73% of cases were diagnosed within 3 weeks of catheter placement. Only one patient developed grade 3 pinch-off 5 weeks following catheter insertion. Lorenz et al. [2] reported one pinch-off sign in a series of 57 patients, initially grade 2, finally grade 3 at 3 months following implantation. A retrospective study from Koonings and Given [3] showed an incidence of pinch-off sign in 5% of cases without any catheter fracture in a series of 100 patients.

In our first case, the catheter had been inserted in a medial position with a radiological pinch-off sign grade 3 at 2 weeks following the operative procedure, even though the attempt had been made to choose a more lateral entry through the skin. The mechanical stress on the catheter was increased by carrying a backpack. In our second case, the scarred skin made it difficult to find the ideal site of puncture. We suspect, that in this case the puncture was in a medial position too, with an initial pinch-off sign grade 1. In this case, the catheter fracture occurred at least 4 months after insertion.

CONCLUSIONS

We suggest the following precautions when introducing a totally implantable long-term central venous access system to avoid a pinch-off syndrome:

1. Penetration of the skin with the puncture needle lateral to the midclavicular line. Direct puncture of the vein without bending the needle under the clavicle.
2. In case of difficult puncture of the subclavian vein, the patient's position should not be optimized to produce a temporary widening of the clavicular-first rib angle.
3. If the postoperative chest radiograph shows the typical pinch-off sign, the patient should be followed carefully by chest radiograph every 4 weeks.
4. In case of the typical pinch-off sign, the catheter system should be removed within 6 months whenever possible.

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